DOCUMENT RESUME

ED 220 524 TM 820 545

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TITLE The Effectiveness of Time Management Directions and Assistance on Anagram Test Performance and State Anxiety.
PUB DATE Feb 82
NOTE 25p.; Paper presented at the Annual Meeting of the Southwest Educational Research Association (Austin, TX, February, 1982).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Analysis of Variance; *Anxiety; Higher Education; Performance Factors; *Test Anxiety; Test Coaching; *Test Wiseness
IDENTIFIERS *State Anxiety; Test Anxiety Inventory (Spielberger); *Time Management; Time Utilization; Worry Emotionality Scale (Liebert and Morris)

ABSTRACT

An anagram test administered under varying time parameters was used to evaluate the effectiveness of test-wiseness strategy. The relationship between test and state anxiety, and specific test-wiseness skills was explored. Students completed an anagram test in 15 or 25 minutes. Two groups received time-using directions and assistance during the test while the other groups did not. State anxiety questionnaires were completed before and after the anagram test, followed by a test-wiseness scale. The longer test administration time was associated with higher anagram scores. The time-using/assistance strategy did not lead to higher anagram performance, although the number of anagrams was positively related to performance. The time-using strategy group reported lower worry in the 15 minute testing condition. Correlation analyses indicated state worry was negatively related to anagram performance and the number of anagram attempts. Test-wiseness was related to both test and state anxiety. Results indicated test-wiseness strategy directions and assistance during the test can have positive affective benefits. Evaluation of test-wiseness component strategies should be conducted individually with multiple dependent variables and different test administration conditions. Test and state anxiety should be included as an integral component of the test-wiseness taxonomy. (DWH)

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The Effectiveness of Time Management Directions and Assistance on Anagram Test Performance and State Anxiety

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TM 820 515

Paper presented at the meeting of the Southwest Educational Research Association, Austin, Texas, February 1982.

Abstract

The effectiveness of a general test-wiseness strategy (time-using) was evaluated in the context of an anagram test administered under varying time parameters. The study also explored the relationship between test anxiety, state anxiety, and specific test-wiseness skills. Eighty-one psychology students completed an anagram test in either 15 or 25 minutes and received (or did not receive) time-using directions and assistance during the test. State anxiety questionnaires were completed prior to and following the anagram test. Students then completed a 25-item test-wiseness scale. As expected, the longer test administration time was associated with higher anagram scores and number of anagrams attempted. In comparison to no strategy, the time-using/assistance strategy did not lead to higher anagram performance, although number of anagrams was positively related to performance. However, the time-using strategy group reported lower worry in the 15-minute testing condition but higher worry in the 25-minute testing condition in comparison to the no strategy groups. The correlation analyses indicated that state worry was reliably related (negatively) to anagram performance and number of anagram attempts. The results also indicated that test-wiseness was related to both test anxiety and state anxiety.

Collectively, the results indicated that test-wiseness strategy directions and assistance during the test can have positive affective benefits (lower worry), but that the effects may be limited to more speeded test conditions. The pattern of cognitive and affective results also indicates the importance of evaluating test-wiseness component strategies individually with multiple dependent variables and different test administration conditions. Researchers should strongly consider including test anxiety and state anxiety as an integral component of the test-wiseness taxonomy.

The Effectiveness of Time Management Directions and Assistance on Anagram Test Performance and State Anxiety[1]

A growing literature addresses the problems associated with teaching children and adults test-taking skills, partially motivated by the adoption of competency exams for high school graduation in well over thirty states. The classic reference (although dated) in this area called test-wiseness is Millman, Bishop, and Ebel (1965) and includes skills independent of test type or purpose (e.g., time-using, error avoidance, guessing, deductive reasoning) and those that depend upon situational characteristics (intent consideration and cue-using). Recent reviews (Ford, 1973; Nilsson, & Wedman, 1976; Sarnacki, 1979) indicate the efficacy of test-wiseness training across a variety of grade levels and tests. This research is not without its problems, however.

First, the majority of such training focuses on teaching students to recognize flaws in the construction of multiple-choice items (cue-using) and perhaps has limited generalizability for the student. Second, the research designs usually involved programs with multiple components of test-wiseness and it is difficult to determine the relative importance of any one general or specific strategy (Bajtelsmit, 1975). And third, the training programs and self-instructional packages generally excluded the management of test anxiety as a major objective. The work of Bajtelsmit (1975) at the American College is a notable exception to the third problem area. His program includes both cognitive and affective components (relaxation training) and is directed toward an adult population.

One of the more widely-generalizable components of test-wiseness in the Millman et al. (1965) taxonomy is related to using time wisely or time management during a test. On the practical level, a number of teachers often help students to pace themselves during a classroom test. Unfortunately, research does not provide any empirical support for this action. The primary purpose of the present study was to evaluate the effectiveness of time management directions and assistance during a test under varying time parameters (fast, slow). It would appear reasonable that time-using strategies would be more important under more speeded test conditions. An anagram test was selected because of its sensitivity to different experimental directions and because of its link to previous test anxiety research (See Sarason, 1980 for example).

The evaluation strategy also included measures of state worry and emotionality (Morris, Davis, & Hutchings, 1981) and multiple measures of problem solving performance and efficiency. The design enables us to gather information on two potential mechanisms underlying any positive performance effects (i.e., time-using strategy, reduction of worry/emotionality, or both). A secondary purpose was to explore the relationship between a new measure of test anxiety (Test Anxiety Inventory: Spielberger et al., 1980), the WEQ, and a measure of test-wiseness skill (Test of Obscure Knowledge: Bajtelsmit, 1975) related specifically to multiple-choice tests. This would allow for a comparison of the relationships of test anxiety and state anxiety to a general test-taking skill and to skills specific to multiple-choice tests.

Method

Subjects

A total of 81 psychology students from a metropolitan university (30 males; 51 females) participated in the experiment: three students were deleted from the major ANOVA analyses due to missing data. Correlations, however, were based on all available data. All students received course credit for their participation. Scores for these students on the Test Anxiety Inventory (TAI: Spielberger et al., 1980) were available from previous testing. The experiment was conducted in small groups of 8 - 10 students with random assignment of students to the four conditions. Since the initial analyses disclosed no difference in effects for men and women, data is reported for the combined groups of men and women.

Measures of Worry and Emotionality

The revised Worry-Emotionality Questionnaire (WEQ: Morris et al., 1981) was used to measure state worry and emotionality. This ten-item scale was used to measure the intensity levels of students' cognitive concern (worry) and physiological arousal (emotionality) prior to and during the anagram problem solving task. Each subscale consists of five items.

Measure of Test-Wiseness

A twenty-five item version of the Test of Obscure Knowledge (TOOK: Bajtelsmit, 1975) was used to assess students' test-wiseness in relation to multiple-choice tests. The test yielded five subscores: specific determiners, stem option relationships, giveaways, similar options, absurd options.

Experimental Design

The experimental design consisted of a 2 x 2 factorial. The independent variables were time management directions and assistance (yes, no) and length of testing time (15 or 25 minutes).

Procedure

At the beginning of the experimental sessions, students received general information about the experiment and signed consent forms. To insure confidentiality, the consent forms were separated from the booklets and passed to the experimenter. Students then read silently the directions for Part I. These instructions described Part I as a timed intelligence test involving a series of anagrams. A definition, example, and solution to an anagram was then provided.

Sarason's stress instructions were used for all students (Sarason, 1961, 1972, 1973). They stated:

> It is important for you to solve as many anagrams as possible in the time allowed to compare well with others. Ability to organize material such as these anagrams has been found to be related to word fluency, a strong component of general intelligence. College students have been found to solve these particular anagrams quickly and with little difficulty and you should have little trouble. You will have (15 or 25) minutes to complete the anagrams.

For those students receiving time management assistance and directions, the following directions were then provided:

> In solving the anagrams, we have found that individuals who use their time wisely and attempt all of the anagrams tend to solve more of them. Since there are thirteen anagrams and you have (15 or 25) minutes, you should plan on working on about 4 anagrams per (5 to 8) minute period. To help you keep track of time, we will write the time remaining on the board for you and indicate which anagrams you should be trying to solve.

After finishing with the directions, all students turned to the next page in their booklets and completed the WEQ which was presented with present tense instructions (i.e., "indicate your feelings, attitudes, or thoughts as they are right now prior to the anagram test.").

The students were then allowed either 15 or 25 minutes for the anagram test. In the time management directions/assistance conditions, the experimenter

briefly interrupted the students twice to inform them of the time remaining and which set of anagrams (second, third) they should now attempt.

At the end of the anagram test, all students completed the WEQ administered with retrospective state instructions (i.e., "indicate your feelings, attitudes, or thoughts as they were when you were attempting to solve the anagrams.").

For Part II of the experiment, students were told that we were interested in their ability to answer a variety of test questions. Even though the questions covered a wide area of knowledge (science, geography, art, etc.), they were told that they should be able to deduce the correct answers if they used their general test-taking abilities. Students were permitted 20 minutes to complete the abbreviated version of the TOOK. The students were then debriefed and given an opportunity to ask questions about the experiment.

Results

Anagram Problem Solving Performance

The means and standard deviations of four problem solving indices are presented in Table 1. These data were analyzed separately using 2 x 2 ANOVAs with unweighted means solutions. The independent variables were length of testing time (15 or 25 minutes) and time management directions/assistance (yes, no). As to be expected, the longer 25-minute testing periods were associated with higher anagram scores (F (1,77) = 7.22, p <.01; $\bar{X}$'s = 6.56, 4.78), and a higher number of written attempts (F (1,77) = 10.38, p <.001; $\bar{X}$'s = 12.04, 10.22) than the 15-minute testing periods. The crude measures of the efficiency of problem solving (proportion correct solutions to attempts; proportion of incorrect anagrams attempted to number of attempts) were unrelated to either independent variable.

Insert Table 1 about here

Time management directions/assistance did not lead to higher anagram performance, total attempts, proportion of correct solutions to attempts, or proportion of attempted incorrect answers to number of attempts. Similar findings were noted if the mean number of attempts per correct and incorrect anagram solutions were used as the dependent variables.

The correlation was .45 ($p < .001$) between anagram scores and number of total attempts, irrespective of experimental condition. For students in the 15-minute testing periods, the correlation was .40 ($p < .05$). In contrast, the correlation was non-significant ($r = .24$) for students in the 25-minute testing periods.

Impact of Experimental Conditions on Worry and Emotionality

The means and standard deviations of the WEQ worry and emotionality scores are presented in Table 2. These data were evaluated in separate 2 x 2 x 2 ANOVAs (repeated measures) with unweighted means solutions. Overall, worry scores were influenced by the experimental conditions. As to be expected, worry during testing was higher ($\bar{X} = 11.73$) than worry ($\bar{X} = 7.96$) prior to testing ($F(1,77) = 86.61$, $p < .00001$). Both the time management/assistance x length of testing time interaction ($F(1,77) = 5.90$, $p < .02$) and the time management/assistance x pre-post periods interaction ($F(1,77) = 4.04$, $p < .05$) were significant and are presented in Figures 1 and 2.

Insert Table 2 and Figures 1 and 2 about here

As can be seen in Figure 1, the time management/assistance was successful in reducing self-reported worry during the 15-minute testing period ($\bar{X}$ = 8.92). As to be expected, worry scores were higher when no assistance was given ($\bar{X}$ = 10.90) in the 15-minute period. In contrast, worry scores were lower with no assistance in the 25-minute period ($\bar{X}$ = 9.28), but higher with assistance ($\bar{X}$ = 10.30).

The significant time management/assistance by pre-post interaction (See Figure 2) indicated that the pre scores were relatively equivalent ($\bar{X}$'s = 8.16 vs. 7.88) for the time assistance or control groups. However, the increase in worry was less (2.9 points) when students were given time management directions/assistance. None of the other main effects were significant.

Emotionality scores were generally unresponsive to the time management/assistance or length of testing time dimensions. Emotionality scores during the anagram test ($\bar{X}$ = 8.95) were higher than the pre-test ($\bar{X}$ = 6.81) ones (F (1,77) = 31.48, p <.00001), as to be expected. Additional secondary analyses were conducted using test anxiety as a blocking variable (median split within cell), but these did not lead to any different findings with regard to the experimental conditions.

Relationship of Test Anxiety and State Anxiety to Anagram Performance

Correlational analyses were used to examine the relationships of test anxiety and state anxiety (worry and emotionality) to the four anagram performance measures. The major results are presented in Table 3. In general, TAI scores were unrelated to anagram performance with only one of 12 correlations reaching statistical significance. The one significant correlation of .24 indicated that high TAI-Worry scores were associated with fewer written attempts on the correct anagrams (p <.05). For all four performance measures,

the TAI-Worry correlations were higher than the TAI-Emotionality ones, although as indicated, only one correlation was significant.

Insert Table 3 about here

Although the two sets of WEQ worry and emotionality scores were significantly correlated (mean r = .55), the pattern of correlations indicated evidence of discriminant concurrent validity with the performance measures. The WEQ-Worry scores during testing were negatively related to anagram performance for three of the four measures. The average correlation was -.285. In contrast, the pre WEQ-Worry scores were unrelated to performance (mean r = .03). The eight WEQ-Emotionality correlations were all non-sifnificant and near zero (mean r = -.02).

Relation of Test Anxiety, State Anxiety, Anagram Performance and Test-wiseness

The intercorrelations of the Test Anxiety Inventory (TAI) scores, WEQ scores, anagram performance (total scores), and Test of Obscure Knowledge (TOOK) scores are presented in Table 4. As can be seen, the TAI scores were generally unrelated to the TOOK subscale or total scores. Only two of the 18 correlations reached statistical significance.

Insert Table 4 about here

None of the correlations between WEQ Worry scores prior to anagram testing and TOOK scores (specific determiners) were significant. WEQ Emotionality scores at this time were significantly related to specific determiners. WEQ Worry scores during anagram testing were more highly related to TOOK scores, however. Three of the correlations (specific determiners, absurd

options, total score) were significant for these WEQ Worry scores. Only one of the WEQ Emotionality correlations was significant (specific determiners).

Four of the six correlations between the anagram total scores and TOOK scores were significant. Only those between anagram performance and stem option and similar option were non-significant.

Discussion

The pattern of performance and anxiety results clearly indicates that a general test-wiseness strategy (time-using and assistance) can have either positive or negative effects depending upon the speediness of the test. From a positive perspective, in the 15-minute condition, the time-using/assistance strategy was associated with significantly lower worry, but it was not associated with significant anagram scores or total attempt differences. The performance differences were in a direction favorable for the strategy, however. The anagram (5.00) and total attempt (10.68) means were higher than the corresponding no assistance ones (4.57; 9.96), but the effect sizes were small (.16; .27) and not significant given the cell sizes in this experiment.

These positive, yet small, effect sizes suggest that perhaps other strategies are needed to improve anagram scores significantly. Sarason (1978), for example, has shown that limited directions with regard to letter-combination strategies reduced the amount of time needed for college students to solve 10 anagrams by four minutes in comparison to no directions. Johnson (1966), in a review of the anagram literature, suggested that letter-combination strategies might be useful in solving difficult anagrams (such as the present study) in comparison to whole word procedures for easier anagrams. The present data and the previous research suggests that the general test-taking strategies

(e.g., time-using, error avoidance, etc.) may exert small positive influences on test performance. More powerful effects of generalized strategies may be obtained if students are given training and practice in using the strategies rather than just directions and assistance as in the present study. It may also be that more specific strategies may exert more influence on performance than the general strategies.

From a negative perspective, the time-using/assistance strategy was associated with higher worry scores in the 25-minute testing period. This higher worry was associated with lower anagram scores (6.11) and attempts (11.78) than the 25-minute/no assistance condition (7.00; 12.30). Similar to the 15-minute/assistance findings, these effect sizes were small (-.29; -.36), but, in this instance, negative. Why the time-using strategy resulted in higher worry with the longer testing times is a matter of speculation, particularly when performance was higher in the 25-minute conditions overall.

A potential explanation might involve around the level of performance expectations and attributions to these created by the time-using strategy. In the 15-minute/assistance condition (about one anagram/minute), the directions to attempt all anagrams, and not to perseverate on any one anagram may have been viewed as reasonable and helpful. Under speeded test conditions, it is usually a sound strategy to attempt all of the test items or questions. Even though the mean performance level was low (38%), the students may have attributed their own low performance to the strategy's limited usefulness (i.e., "I tried all of them as instructed.") and not as much to their own lack of ability.

In the 25-minute/assistance condition (2 minutes/anagram), however, students may have determined that there was reasonable time to solve the

anagrams, and that their own low performance (47%) was more attributable to their own lack of ability, and less to any generalized test-taking strategy. It's as if being reminded of the time remaining focused their attention on their poor performance. The slightly fewer number of attempts in this condition would fit with this differential cognitive interpretation explanation.

Under the two no assistance conditions, students had less reason to attribute their own ability since they were only told they would be taking an intelligence type test. Under standard test conditions we would expect worry and performance to be more strongly, and negatively related as found in the present study. In these conditions, performance was lower in the 15-minute condition and worry was higher in comparison to the 25-minute condition.

The pattern of worry-anagram performance correlations within the various conditions would be consistent with a cognitive interpretation also. These are detailed as follows:

15-minute/Assistance	-.03
15-minute/No Assistance	-.30
25-minute/Assistance	-.66**
25-minute/No Assistance	-.41*

There was virtually a zero correlation in the speeded/assistance condition and a marginal negative correlation in the speeded/no assistance condition. In contrast, the largest negative correlation was found in the 25-minute assistance condition. Clearly, the time-using directions resulted in markedly different worry reactions in the two test administration conditions providing empirical support for a cognitive model of test anxiety which has increasing support (Sarason, 1980).

The failure to find a performance facilitation effect associated with lower worry in the 15-minute/assistance condition (or decrement in the 25-minute/assistance condition) is not uncommon in the test anxiety

literature (Benjamin et al., 1 .1; Tryon, 1980). Many factors contribute to performance differences among students, and worry accounts for approximately 10 percent of the variance (Morris et al., 1981). Thus, there is clearly no guarantee that reducing test anxiety, even worry, will result in improved performance or vice versa. It should also be remembered that in the present study worry did increase in the assistance conditions, although not as much.

In a recent comprehensive review of the test anxiety treatment literature, Tryon (1980) has shown that a variety of "treatments," both cognitive and behavioral, can have positive affective benefits (lower worry) and not show significant performance effects. It is not clear, however, what specific treatment components account for the reduction in worry (Denny, 1980). It is clear that performance facilitation is not the general rule, however. The present data is consistent with these studies and shows that a general test-taking strategy can have an impact in the affective area under certain test administration conditions, and a small positive performance effect as well.

The present data shows significant relationships between test anxiety, worry/emotionality, and test-wiseness. The TAI-Total and TAI-Worry scores were negatively related to the specific determiner subscale of the modified TOOK. As expected, WEQ scores prior to testing were generally unrelated to TOOK scores. However, WEQ Worry scores during anagram testing were related to the specific determiners, absurd options, and TOOK total scale scores. WEQ Emotionality scores were only related to performance on the specific determiners subscale of the TOOK. Our pattern of significant WEQ worry correlations and non-sifnificant emotionality correlations with anagram

performance and TOOK subscales is quite consistent with research reviewed by Deffenbacher (1980) and Morris et al., (1981) and provides further discriminant concurrent validity evidence for the two state anxiety components as measured by the WEQ.

Bajtelsmit (1975) found negative relationships with state anxiety and TOOK scores for adult students, although Millman (1966) did not find any relation between test anxiety and several test-wiseness measures with junior high school students. Collectively, the correlational data from the present study and previous research suggest that anxiety is related to test-wiseness and that perhaps researchers should assess both the cognitive and affective outcomes of their test-wiseness training. Unfortunately, none of the test-wiseness studies reviewed measured "affective outcomes" of their studies (See reviews by Ford, 1973; Nilsson & Wedman, 1976; Sarnacki, 1979). An important interaction between test administration conditions and strategy/no strategy would have been overlooked in the present study had not measures of worry and emotionality been included as dependent variables.

In summary, the present study indicated that a general test-taking strategy (time-using or time management) produced a significant reduction in state worry under speeded test conditions, but not a significant performance facilitation effect. It also indicated the efficacy of evaluating the importance of general test-taking strategies individually, whereas previous research evaluated an entire 'test-taking skills' package. The present study also indicated the importance of the state worry and emotionality distinction and suggested that anxiety should be considered as part of the test-wiseness taxonomy (e.g., Millman et al., 1965). The data also suggest that more specific problem solving strategies might be needed to impact

performance, such as letter-combination training and awareness. It may be that a wider variety of tests and testing conditions should be studied since particular strategies may be more important under specific conditions as evidenced by the significant interaction in the present study. Bajtelsmit (1977) has made a similar recommendation. Indeed, Benjamin et al. (1981) showed that a test anxiety deficit in performance was larger with open-ended recall test questions (essay, short answer) where time-using and organizational strategies may be very important to better performance.

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Footnotes

1. Paper presented at the meeting of the Southwest Educational Research Association, Austin, Texas, February 1982. The author would likt to thank Fra Burns for his assistance in collecting and reducing data for analysis. The author would also like to thank Patsy Moore for typing, editing, and clerical efforts associated with the study. Requests for copies should be directed to John J. Hedl, Jr., School of Allied Health Sciences, The University of Texas Health Science Center at Dallas, Dallas, Texas 75235.

Table 1

Means and Standard Deviations of the Anagram Performance Measures as a Function of Length of Testing Time and Time Management Assistance/Directions

	Total Score	Number of Attempts	Correct Answer Proportion*	Wrong Answer Proportion**
15 Minutes for Testing				
Assistance				
Mean	5.00	10.68	.45	.33
SD	3.21	2.58	.31	.22
No Assistance				
Mean	4.57	9.76	.53	.32
SD	2.64	3.42	.32	.25
25 Minutes for Testing				
Assistance				
Mean	6.11	11.78	.45	.26
SD	2.78	2.32	.31	.23
No Assistance				
Mean	7.00	12.30	.42	.22
SD	3.11	1.46	.26	.15

* defined as the proportion: $\frac{\text{number of correct solutions}}{\text{\# of written attempts on the correct solutions}}$

** defined as the proportion: $\frac{\text{number of incorrect anagrams attempted}}{\text{\# of written attempts on the incorrect solutions}}$

Table 2

Means and Standard Deviations of the WEQ Worry and Emotionality Scores by Length of Testing Time and Time Management Assistance/Directions

	WEQ Worry		WEQ Emotionality	
	Pre	During	Pre	During
15 Minutes for Testing				
Assistance				
Mean	7.21	10.63	6.68	8.47
SD	2.72	4.02	1.53	4.14
No Assistance				
Mean	8.33	13.48	6.81	9.10
SD	2.18	4.42	1.94	3.94
25 Minutes for Testing				
Assistance				
Mean	9.11	11.50	6.50	8.78
SD	2.49	3.87	1.69	2.71
No Assistance				
Mean	7.35	11.22	7.17	9.34
SD	2.72	3.32	3.08	4.11

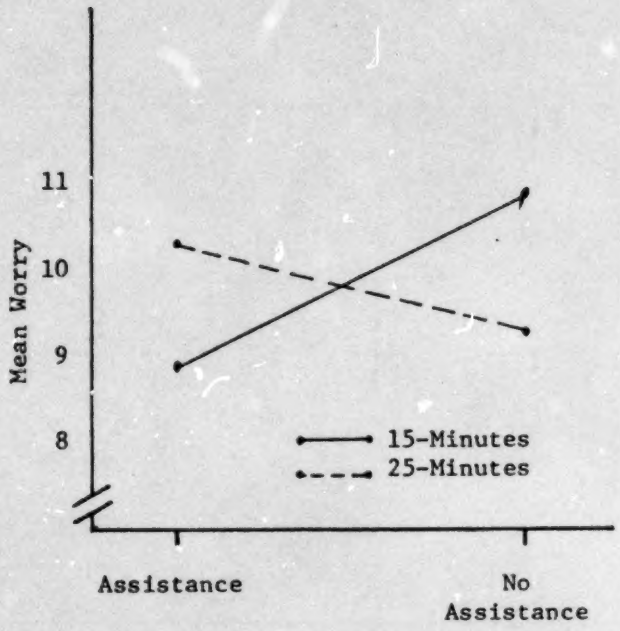

Figure 1. Interaction between length of testing and assistance conditions for WEQ Worry scores.

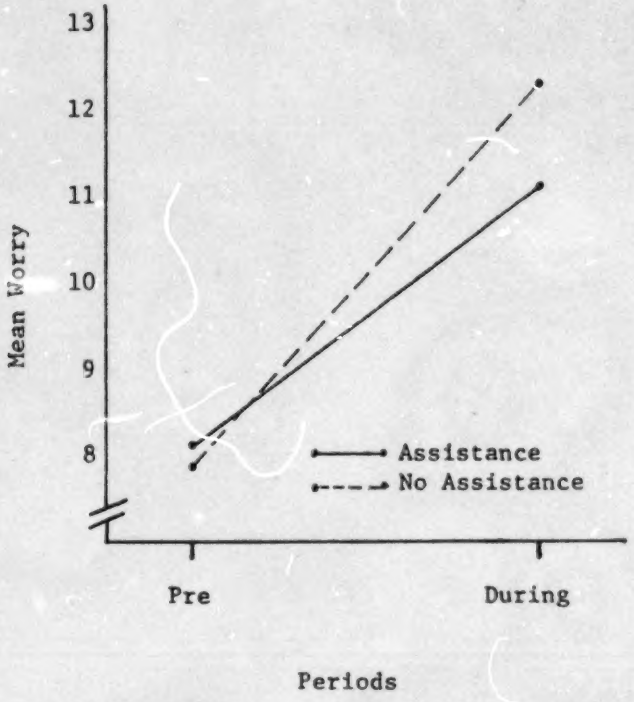

Figure 2. Interaction between assistance conditions and pre-during periods for WEQ Worry scores.

Table 3

Intercorrelations of the Test Anxiety Inventory and WEQ with Anagram Performance

	Test Anxiety Inventory			WEQ Worry		WEQ Emotionality	
Anagram measures	Total	W	E	Pre	During	Pre	During
Total Score	-.04	-.16	.06	-.14	-.34**	-.16	-.10
Total Attempts	-.09	-.15	-.06	.08	-.19*	.00	-.11
Correct Proportion	.13	.24*	.14	.05	-.16	-.08	-.00
Wrong Proportion	.19	.14	.08	.13	-.37**	.05	.20

*p <.05; **p <.01